US009878378B2

(12) **United States Patent**
Bass et al.

(10) **Patent No.: US 9,878,378 B2**
(45) **Date of Patent: Jan. 30, 2018**

(54) **KEY CLAMP ROTATION CONTROLLER**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 686 days.

(21) Appl. No.: **14/312,277**

(22) Filed: **Jun. 23, 2014**

(65) **Prior Publication Data**

US 2014/0300041 A1 Oct. 9, 2014

Related U.S. Application Data

(63) Continuation of application No. 13/361,347, filed on Jan. 30, 2012, now Pat. No. 8,770,564.

(60) Provisional application No. 61/437,197, filed on Jan. 28, 2011.

(51) **Int. Cl.**

B23Q 3/02	(2006.01)
B23C 3/35	(2006.01)
B23Q 3/06	(2006.01)
B25B 1/22	(2006.01)

(52) **U.S. Cl.**

CPC ***B23C 3/355*** (2013.01); ***B23Q 3/061*** (2013.01); ***B25B 1/22*** (2013.01); *Y10T 409/300952* (2015.01)

(58) **Field of Classification Search**

CPC B25B 1/00; B25B 3/00; B25B 5/00; B25B 7/00

See application file for complete search history.

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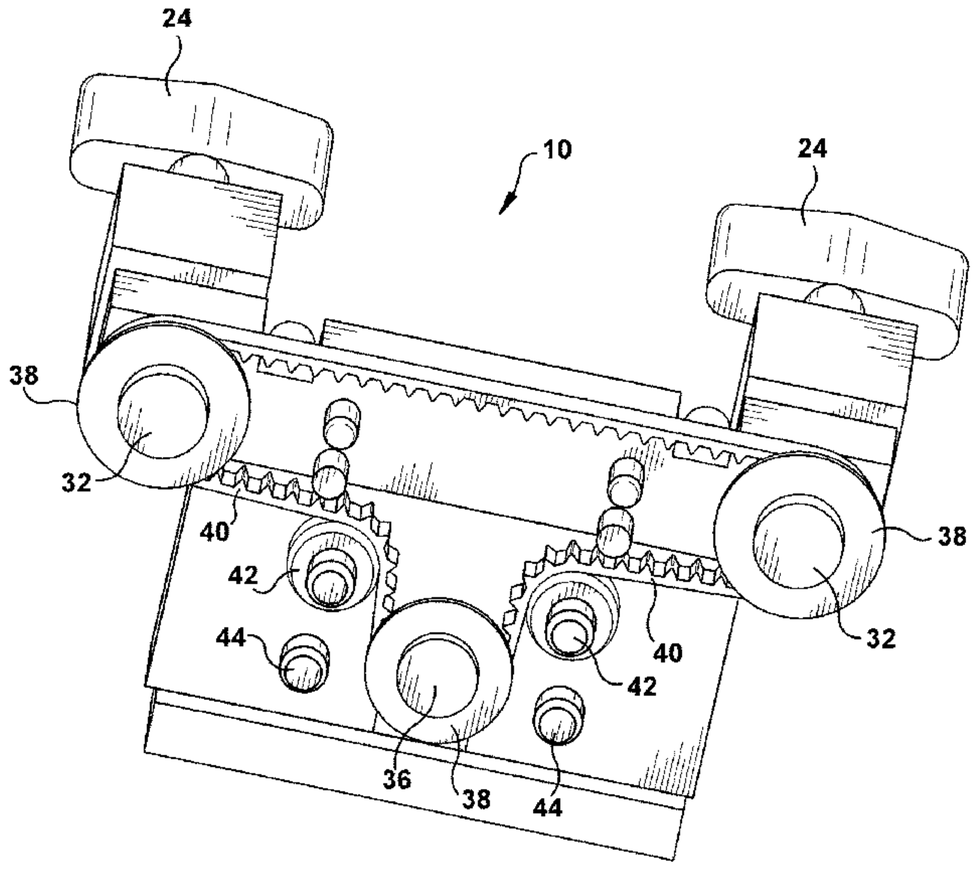
(57) **ABSTRACT**

A key clamping device includes a first key clamp, a second key clamp and a rotational device connected to the first and second key clamps. The rotational device may facilitate rotation of the first and second key clamps.

10 Claims, 3 Drawing Sheets



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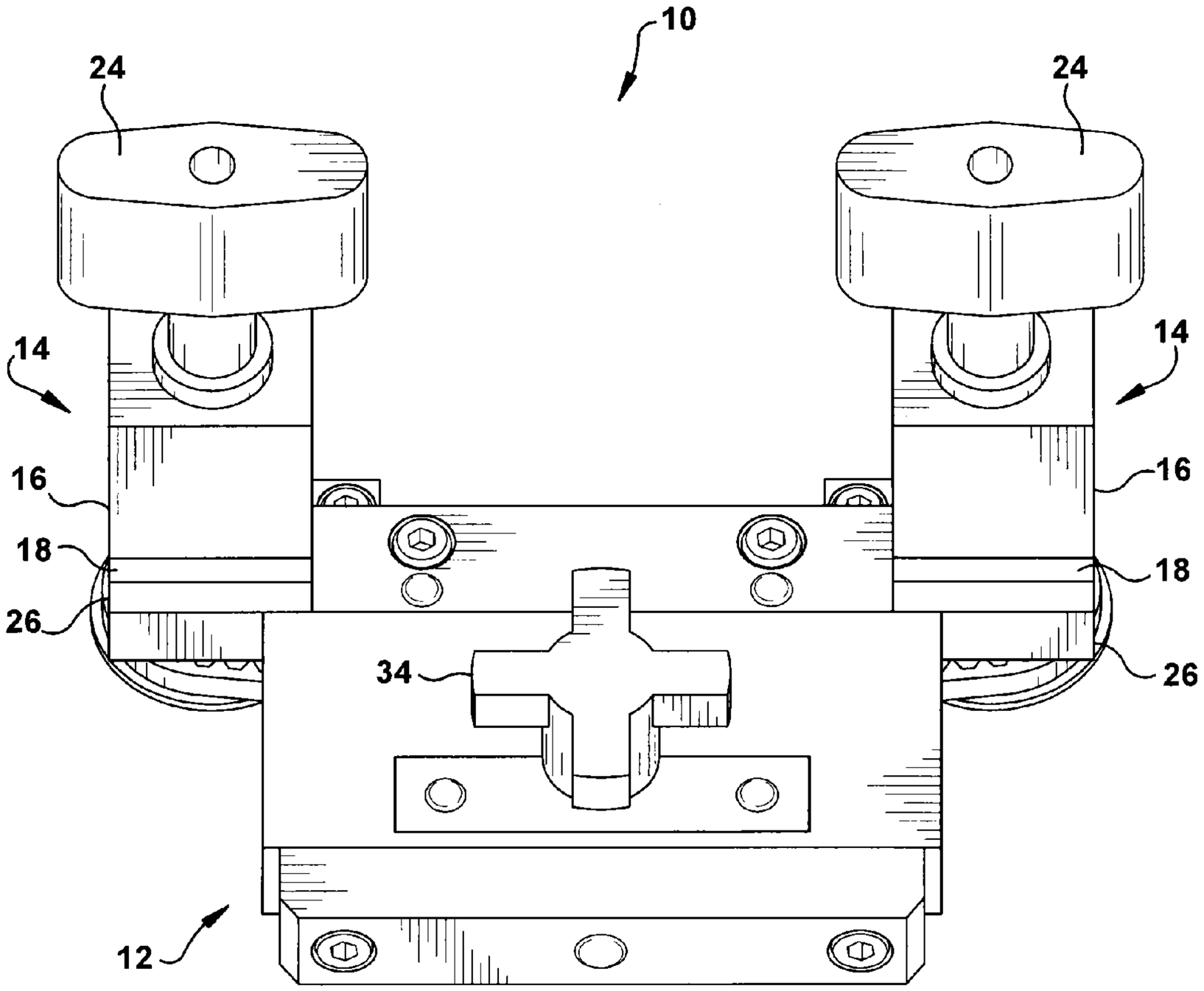

FIG. 1

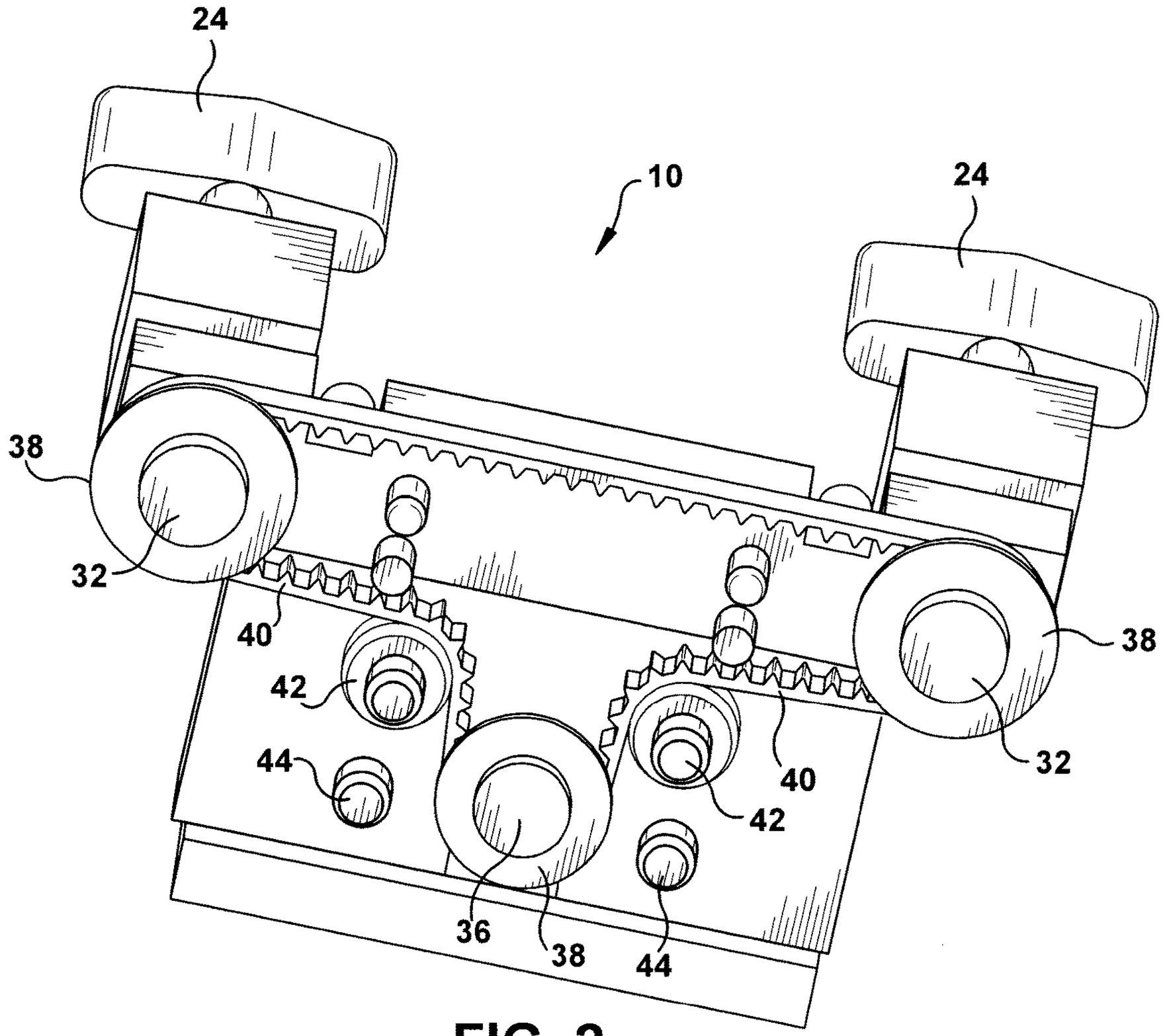

FIG. 2

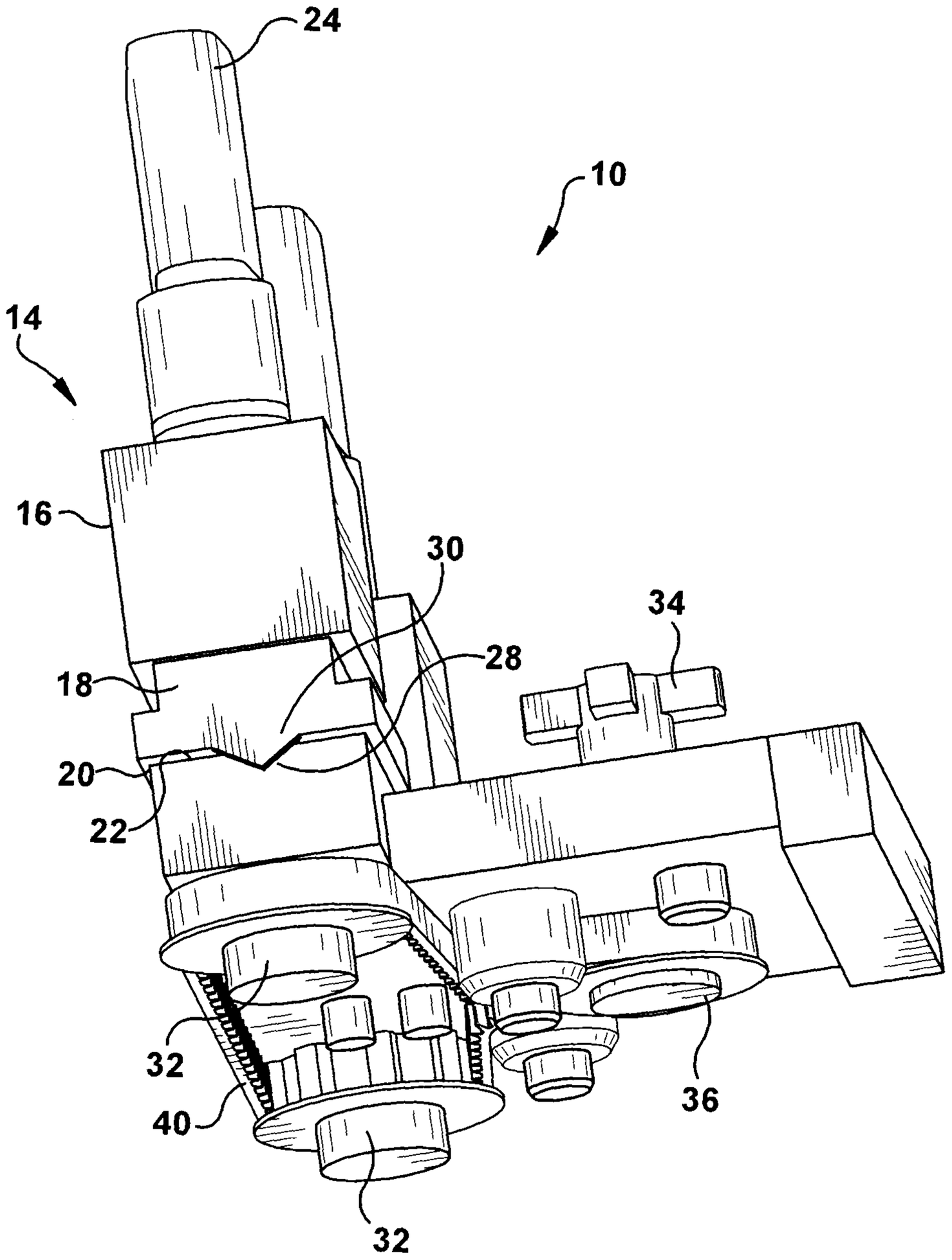

FIG. 3

KEY CLAMP ROTATION CONTROLLER

CROSS-REFERENCE TO RELATED APPLICATION

This application is a continuation of U.S. patent application Ser. No. 13/361,347, now U.S. Pat. No. 8,770,564, filed on Jan. 30, 2012 and entitled "KEY CLAMP ROTATION CONTROLLER," which claims priority to U.S. Provisional Patent Application No. 61/437,197 entitled "KEY CLAMP ROTATION CONTROLLER," filed on Jan. 28, 2011 each of which are hereby incorporated in their entirety by reference.

BACKGROUND

Key cutting machines are known to generally include a clamp in which a key blank is inserted and clamped for subsequent cutting by a milling operation. Conventional key cutting machines often include two such clamps: one for holding an original key already having the desired mechanical code cut therein, and one for holding a key blank to be cut. More recent key cutting machines include only one clamp for holding the key blank, as all of the cutting information may be stored electronically.

Keys come in many different styles, such as house keys and car keys, sidewinder keys, tubular keys, and other various types and styles of keys. Depending on its size and shape, each style of key may require a different clamping mechanism to properly hold the key blank in place while the key cutting machine cuts the appropriate bitting pattern into the key blank. Furthermore, depending on the design of the key cutting machine, different keys may require different clamping orientations, such as parallel or perpendicular to the cutting machine, in order to properly engage the cutting tool during the key cutting process.

Many conventional keys, such as house keys and car keys, are traditionally flat, and include a blade portion and a base portion. Such conventional keys come in various lengths and widths, and have any number of different grooves along the blade of the key. To properly hold a standard key in place while it is being cut, the blocks that engage and clamp the key must align with the key's length, width and groove configuration. Thus, for a key cutting machine to be capable of cutting various types of keys, it must have multiple clamping surfaces for properly clamping each type of key.

Several key clamps have been designed to provide clamping for various types and styles of keys. For example, key clamps have been designed with multiple clamping sides, each side capable of clamping a different key geometries. The clamp is then rotatable to orient the clamping side with the desired geometry facing the key cutting machine. However, key cutting machines with two or more key clamps of this design require that the clamps are rotated such that matching sides are oriented toward the key cutting machine to ensure that a clamped key blank matches the key style of the master key that is being cut.

SUMMARY

A key clamping device is generally presented. The key clamping device includes a first key clamp, a second key clamp and a rotational device connected to the first and second key clamps. The rotational device may facilitate rotation of the first and second key clamps.

In an embodiment, the key clamping device may include a belt to interconnect the rotational device, first key clamp and second key clamp. The belt may engage a gear connected to the first key clamp, a gear connected to the second key clamp, and a gear connected to the rotational device to translate rotation of the rotational device to the two key clamps.

DESCRIPTION OF THE DRAWINGS

Objects and advantages together with the operation of the invention may be better understood by reference to the following detailed description taken in connection with the following illustrations, wherein:

FIG. **1** is a top perspective view of a key clamping mechanism.

FIG. **2** is a bottom perspective view of a key clamping mechanism.

FIG. **3** is a side perspective view of a key clamping mechanism.

DETAILED DESCRIPTION

While the invention is described with reference to key cutting machines, it will be appreciated that the invention should not be limited to such uses or embodiments. The description herein is merely illustrative of embodiments of the invention and in no way should limit the scope of the invention.

With reference to FIGS. **1-3**, a key clamping device **10** is provided. The key clamping device **10** may be capable of clamping various types and configurations of keys. A given key cutting machine may include one, two, or any number of key clamping devices **10**, depending on the design of the machine. A clamping device **10** may be used to hold a key, such as a master key having a bitting pattern cut into the blade or a key blank having an uncut blade.

The key clamping device **10** may include a carriage **12** to support one or more key clamps **14**. The carriage **12** may be any appropriate size and shape, such as generally rectangular, and may connect to a key cutting machine to move with respect thereto.

As shown in FIGS. **1-3**, the key clamping device **10** may include two key clamps **14**. The key clamps **14** may be located at any appropriate position on the key clamping device **10**, such as connected to the carriage **12**. The carriage **12** may be moveable to move the key clamps **14** between multiple positions. For example, the carriage **12** may be moveable between a first position wherein the key clamps **14** are a distance away from components of the key cutting machine such as a key cutter, and a second position where the key clamps **14** are proximate to the components of the key cutting machine.

The key clamps **14** may be configured to clamp various styles of keys. For example, the key clamps **14** may include a clamp block **16** and a base block **18**. The clamp block **16** and base block **18** may be any appropriate size and shape and may be located at any appropriate position. For example, the clamp block **16** may be positioned above the base block **18** such that the bottom surface **20** of the clamp block **16** engages the top surface **22** of the base block **18**. The bottom surface **20** and top surface **22** may be configured to engage a key therebetween. For example, the bottom surface **20** and top surface **22** may comprise a geometry configured to engage portions of a key, such as the key blade. The bottom surface **20** and top surface **22** may be configured to engage a standard blade, a narrow blade, a wide blade, an X blade, or any other type of key blade known in the art.

The key clamps **14** may include any appropriate number of sides. For example, as shown in FIGS. **1-3**, the key clamps **14** may include four sides. It will be appreciated, however, that the key clamps **14** may each include three, four, five, six or any number of sides. Each side of the key clamp **14** may comprise a different engagement between the bottom surface **20** and top surface **22**. For example, a first side of the key clamp **14** may be configured to engage a standard blade, a second may be configured to engage a narrow blade, a third side may be configured to engage a wide blade, and a fourth side may be configured to engage an X blade.

The key clamps **14** may be loosened to allow a key to be placed in the clamp and may be tightened to clamp the key into place. To that end, the key clamps **14** may include a knob **24** to facilitate tightening and loosening of the key clamps **14**. The knob **24** may be any appropriate size or shape and may be located at any appropriate position on the key clamps, such as on top of the clamp block **16**. In an embodiment, the knob **24** may engage a screw (not shown) that extends through the key clamp **14**. Rotation of the knob **24** may turn the screw to loosen or tighten the key clamp **14**.

The key clamps **14** may include a support block **26**. The support block **26** may be any appropriate size and shape and may be located at any appropriate position, such as beneath the base block **18** to support the key clamp **14**. The support block **26** may include one or more detents **28** to receive one or more protrusions **30** in the base block **18**. The detents **28** and protrusions **30** may be any appropriate size and shape and may be located at any appropriate position on the key clamps **14**. For example, the detents **28** may be v-shaped to receive a similarly v-shaped protrusion **30**. It will be appreciated, however, that the detents **28** and protrusions **30** may be any size or shape.

The key clamps **14** may include any number of detents **28** and protrusions **30** on each of its sides, such as one detent **28** and one protrusion **30** each centrally located on each side. The detent **28** and protrusion **30** may be aligned to allow the protrusion **30** to be nested within the detent **28**. Further, the detents **28** and protrusions **30** on each side of the key clamps **14** may be sized, shaped and positioned to allow the protrusions **30** on a first side of the clamp block **16** to engage detents **28** on all other sides of the base block **18**.

The key clamps **14** may be rotatable with respect to the carriage **12**. For example, the key clamps **14** may include a spring (not shown) or other similar biasing device positioned within the key clamp **14**. The spring may allow the base block **18** and clamp block **16** to be lifted away from the support block **26** such that the protrusions **30** are disengaged from the detents **28**. Once the protrusions **30** are clear of the detents **28** the key clamps **14** may be rotated to position the desired side at the clamping location.

The key clamps **14** may include a rotation shaft **32**. The rotation shaft **32** may be an appropriate size and shape and may be located at any appropriate position, such as centrally positioned within the key clamp **14**. The rotation shaft **32** may extend through the support block **26** to the underside of the key clamping device **10**. The rotation shaft **32** may engage a portion of the clamp block **16** and base block **18** such that rotation of the shaft **32** rotates the clamp and base block **16**, **18** and vice versa.

It may be advantageous to tie rotation of a first key clamp **14** to rotation of a second key clamp **14**. For example, tying rotation of the first key clamp **14** to maintain alignment with the second clamp **14** such that each clamp **14** maintains a similarly configured side in the clamping position at all times. Tying rotation of the key clamps **14** may further allow both the first and second key clamps **14** to be rotated from a single rotation point.

The key clamping device **10** may include a control dial **34**. The control dial **34** may be located at any appropriate position, such as centrally located on the carriage **12** between the key clamps **14**. The control dial **34** may include a control shaft **36**. The control shaft **36** may be any appropriate size and shape and may extend through the carriage **12** to the underside of the clamping device **10**. The control shaft **36** may be connected to the control dial **34** such that it rotates therewith.

The key clamping device **10** may include one or more gears **38**. The gears **38** may be any size and shape, such as circular, and may be positioned at any appropriate location. For example, the clamping device **10** may include one or more gears **38** positioned about a portion of each rotation shaft **32** and about a portion of the control shaft **36** to rotate therewith.

The clamping device **10** may include a belt **40** or similar device to interconnect the control shaft **36** and one or more rotation shafts **32**. The belt **40** may be any appropriate size and shape and may include any number of teeth **42**. The teeth **40** may be sized and shaped to engage similarly shaped openings in the gears **38**.

The belt **40** may be arranged to interconnect the gears **38** as illustrated in FIG. **2**. The clamping device **10** may include one or more bearings **44** to constrain the path of the belt **40**. The bearings **44** may be any appropriate size and shape, such as cylindrical. The bearings **44** may engage a flat back surface of the belt **40** and rotate therewith. While the clamping device **10** is described herein as utilizing a belt and gear system to interconnect the rotation shafts **32** and control shaft **36**, it will be appreciated that any means known in the art may be used to accomplish such interconnection.

In an embodiment, components of the clamping device **10** may be powered or controlled automatically. For example, the control shaft **36** may be powered by a motor, such as a stepper motor, solenoid, air cylinder or other automated device (not shown). The automated device may rotate the control shaft **36** to the desired position. The clamping device **10** may include sensors to provide feedback of the control shaft's position.

In an embodiment, the key clamping device **10** may be configured to automatically select a clamping surface based on a specified input. For example, the control shaft **36** may be powered by a motor that is connected to a motor controller or microcontroller. The microcontroller may further be configured to receive inputs, such as inputs related to a selected key to be copied. For example, the microcontroller may receive information related to a scan or digital image of a selected key. The microcontroller may then direct the motor to rotate appropriately to select the corresponding sides the key clamps **14** that correspond to the key blank of the selected key. It will be appreciated, however, that such automated use is simply one embodiment and that manual use of the device may be appropriate as well.

In use, the control dial **34** may be turned to control rotation of the key clamps **14**. The knobs **24** may be unscrewed to loosened the key clamps **14** prior to turning the control dial **34** in order to ease rotation. However, the dial **34** may be rotated without first loosening the knobs **24**. Rotation of the dial **34** may cause a gear **38** connected to the control shaft **36** to rotate. The control gear **38** may facilitation rotation of the belt/gear system to cause rotation of the

key clamps **14**. A user may rotate the control dial **34** until the desired face of the key clamps **14** is located at the clamping position.

The invention has been described above and modifications and alternations will occur to others upon a reading and understanding of this specification. The claims as follows are intended to include all modifications and alterations insofar as they come within the scope of the claims or the equivalent thereof.

Having thus described the invention, we claim:

1. A key cutting machine comprising:
a carriage;
a first key clamp connected to the carriage;
a second key clamp connected to the carriage;
a rotational device connected to the carriage and interconnecting the first key clamp and second key clamp;
wherein, rotation of the rotational device causes rotation of the first key clamp and second key clamp.

2. The key cutting machine of claim **1**, wherein the first key clamp and second key clamp are each rotatable with respect to the carriage.

3. The key cutting machine of claim **1**, wherein the rotational device comprises a control shaft and a dial connected to the rotational shaft.

4. The key cutting machine of claim **3** further comprising:
a first gear connected to the control shaft;
a second gear connected to the first key clamp;
a third gear connected to the second key clamp; and
a belt interconnecting the first gear, second gear, and third gear.

5. The key cutting machine of claim **4** further comprising at least one bearing arranged to constrain the belt.

6. The key cutting machine of claim **1** wherein the first key clamp and the second key clamp each have four sides.

7. The key cutting machine of claim **1** wherein the first key clamp and the second key clamp each comprise a clamping block and a base block.

8. The key cutting machine of claim **7**, wherein the first key clamp and the second key clamp each further comprise a support block arranged to support the base block.

9. The key cutting machine of claim **8**, wherein the base block includes a protrusion and the support block includes a detent configured to receive the protrusion.

10. The key cutting machine of claim **1**, wherein the first key clamp and the second key clamp each include a rotational knob arranged to tighten the first key clamp and the second key clamp.

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